

SCIENCE

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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Prof. J. McKeen Cattell, Garrison-on-Hudson, N. Y.

WEISMANN ON GERMINAL SELECTION.

THIS last contribution of Prof. Weismann to his system of inheritance and evolution hypotheses was presented to the International Congress of Zoölogists at Leyden last September. It was published in German at the beginning of the current year, and has just appeared in English as No. 19 of the Religion of Science Series (Open Court Publishing Co., Chicago).

It is evident from many expressions throughout the paper that Prof. Weismann considers this one of the most important of all his contributions on the evolution problem, and even those who cannot accept this most advanced and in some respects most speculative of all his hypotheses will nevertheless be inclined to regard the paper as important in marking some fundamental changes in Weismann's position.

During the long continued discussion between Weismann, Spencer and others there was a feeling in certain quarters that something was wrong with the methods employed and that the deadlock of opinion could not be broken by inductive reasoning alone. Weismann's present paper, however, gives evidence that many of the objections raised by his opponents have taken deep hold upon him, and have, in fact, convinced him that his former position was untenable. "The real aim of the present essay," says Weismann, "is to rehabilitate the principle of selection. If I should suc-

ceed in reinstating this principle in its imperilled rights it would be a source of extreme satisfaction to me." To hear the author of 'Die Allmacht der Naturzüchtung' speak of 'rehabilitating' and 'reinstating' the principle of selection betokens a revolution of opinion scarcely less sudden and wonderful than that manifested in a certain historic conversion on the way to Damascus.

In this paper Weismann expressly makes the following concessions: 1. "The principle of panmyxia is not alone sufficient for a full explanation of the phenomena (of degeneration). My opponents in advancing this objection are right to the extent indicated and as I expressly acknowledge." 2. "The Lamarckians were right when they maintained that the factor for which hitherto the name of natural selection had been exclusively reserved, viz., *personal* selection, was insufficient for the explanation of the phenomena" (of the disappearance of useless parts). 3. "The fact of a simultaneous, functionally concordant yet essentially diversified modification of numerous parts points conclusively to the circumstance that *something is still wanting to the selection of Darwin and Wallace which it is obligatory on us to discover if we possibly can, and without which selection as yet offers no complete explanation of the phyletic processes of transformation. There is a hidden secret to be unriddled here before we can obtain a satisfactory insight into the phenomena in question. We must seek to discover why it happens that the useful variations are always present.*"

These are most fundamental concessions, yet it must not be supposed that they necessarily lead to the Lamarckian position. The insufficiency of natural selection to explain all the phenomena of phyletic transformation Weismann attributes to the fact that this principle has been unduly limited in its field of operation; it has heretofore been regarded as applicable only to *persons*;

it should be considered as applicable to every organic unit, whether visible or invisible, even down to the hypothetical biophores.

Natural selection occurs among all orders of individuality, colonies, persons, organs and tissues, determinants and biophores, and corresponding to these different units Weismann recognizes "three principal stages of selection: That of *personal* selection as it was enunciated by Darwin and Wallace; that of *histonal* selection as it was established by Wilhelm Roux in the form of a 'struggle of the parts,' and finally that of *germinal* selection whose existence and efficacy," he says, "I have endeavored to substantiate in this article—these are the factors which have coöperated to maintain the forms of life in a constant state of variability and to adapt them to their conditions of life." In brief, natural selection is still omnipotent if only it be regarded as omnipresent.

Germinal selection consists in an extension of this principle of selection to the determinants and biophores and it may be reduced to the following propositions:

1. "Every independently and hereditarily variable part is represented in the germ by a determinative group of vital units, whose size and power of assimilation correspond to the size and vigor of the part."

2. Variations in the size of determinants (some being larger, some smaller and some the same size as the maternal determinants) are caused by 'the inevitable fluctuations of the nutrient supply.' *The ultimate cause of all inherited variations in size is, therefore, to be found in the influence of nutrition on the determinants.*

3. The *quality* of a determinant depends upon the numerical proportion of the biophores which it contains. If that proportion is altered so also is the *character* of the determinant. The struggle for nutriment, with its subsequent preference of the strong-

est, must take place between the various species of biophores as well as between the species of determinants. By the continued weakening of a biophore until it ultimately disappeared the quality of the determinant to which it belonged would be changed. *The ultimate cause of all variations in kind is, therefore, due to the varying amount of nutriment supplied to the biophores.*

4. "Every determinant battles stoutly with its neighbors for food."

5. The weaker determinant "will be unable to obtain the full quantum of food * * * and the result will be that its progeny will be weakened still more * * * and inevitably the average strength of this determinant must slowly but constantly diminish."

6. The stronger determinants "oppose a relatively more powerful front to their neighbors, that is, actively absorb more nutriment, and upon the whole increase in vigor and produce more robust descendants."

7. The plus and minus variations may go on simultaneously and independently in many groups of determinants. When in any case they have reached selection value they may be checked or increased by personal selection. "In this manner it becomes intelligible how a large number of modifications, varying in kind and far more so in degree, can be guided *simultaneously* by personal selection."

The possible application of some of these principles is illustrated by cases of mimicry shown in the wings of butterflies, and the necessity of retaining the principle of natural selection to explain mimicry and adaptations in general is ably shown. In conclusion the author says: "We had applied the principle of natural selection to a part of the natural units engaged in struggle. If we apply the principle throughout we reach a satisfactory explanation. Selection of *persons* alone is not sufficient to explain the

phenomena; *germinal* selection must be added. Germinal selection is the last consequence of the application of the principle of Malthus to living nature." * * * "This proposition seems to me to round off the whole theory of selection and to give it that degree of inner perfection and completeness which is necessary to protect it against the many doubts which have gathered around it on all sides like so many lowering thunder clouds."

Regarding Weismann's recent concessions to his opponents, it should be observed that he does not make them until having gotten a new foothold on the principle of germinal selection he can afford to yield these points. He nowhere makes adequate acknowledgment of the force of the facts urged against natural selection, nor the insufficiency of the latter until he feels sure that he can save his pet theory by another theory. In short, it would appear that with him the all-sufficiency of natural selection is a foregone conclusion, and however weighty the arguments may be which are brought against his position he disregards them until he is able to explain them in conformity with his theory.

This new hypothesis of germinal selection is a bold attempt to explain the causes of *all* variations and the usefulness, or adaptive character, of many variations upon the selection principle. With such high aims it is an extremely important contribution, whatever may be thought of its probability. To the writer it seems that Weismann fails to recognize that the 'selection' which he predicates of determinants and biophores is a wholly different principle from the natural selection of Darwin and Wallace. Both natural and artificial selection signify that in the struggle for existence certain individuals and races are *selected* and others *rejected*. If the unfit should survive and leave as many offspring as the fit there would certainly be no such thing as natural selec-

tion. Germinal selection, however, signifies that certain germinal units grow larger through increased nutrition; that this purely acquired character is transmitted to their descendants, and that these stronger determinants leave no *more* progeny, but simply *stronger* progeny; the weaker determinants leave no *fewer*, but simply *weaker* descendants. In short, the process is wholly and simply the continued inheritance of an acquired character. In the whole process there is no *selection* or *rejection*, but merely a continuance of individual determinants with the transmission of characters acquired by them to their descendants. How very different this is from the usual meaning of the term *selection* Professor Weismann, perhaps better than any other, could explain.

As to the evidence for germinal selection Weismann frankly avows that he "can adduce nothing except that it is at present the only explanation that can be given," and in this regard it should be observed that it stands upon a distinctly different basis from *personal* selection or *histonal* selection, each of which is directly supported by a very large number of observations and is a legitimate deduction from the facts, whereas germinal selection is confessedly merely an inductive speculation.

Evidence should be the crucial test for this as for any theory, and yet it is at this very point that it is weakest. Not a particle of evidence is adduced in proof of a single proposition named. Apart from the fundamental conception of determinants, which is still a mere matter of speculation and upon which the gravest doubts exist in the minds of many eminent men, some evidence may be adduced against certain of the propositions named:

1. The idea that the size of a determinant corresponds to the size and vigor of the part to which it gives rise, or the *determinate* as Weismann calls it, is neither a necessary conclusion nor indeed a highly

probable one. If space permitted, much evidence might be brought forward, based on a study of precocious development and larval organs, to show that the size of the cell or region of the egg which gives rise to a certain part does not generally correspond to the *size* of the part, but rather to the *time* of its formation. To be sure cells and regions of the egg are not determinants in Weismann's sense, but they are frequently the *Anlagen* of organs, and as such are the nearest approach to the determinants of Weismann which may be recognized by observation. Judging the unseen therefore by the seen, there is a certain amount of evidence that the longevity of a determinant and the rapidity of the transformations which it is able to undergo, rather than its size, stands in direct relation to the size and vigor of the determinate, and it may well be that the simpler and smaller determinants, and not the larger ones, possess the greatest stability and longevity.

2. "Every determinant battles stoutly with its neighbors for food." I suppose Professor Weismann must regard this as a mere figure of speech, in fact not only the battle and the means of warfare, but the combatants and the cause of battle must all be figurative, as they are all imaginary. But what evidence or probability is there that there is not food enough for every determinant to live on and grow fat? Do the determinants increase in geometrical ratio; does each species require a different kind of food, and must we after all suppose that with divine prescience nature has taken care to supply less food to the determinants than they need in order that they may battle with each other? Such questions are asked in good faith, though one shrinks from asking them lest he may be classed by Weismann with 'the hotspurs of biology, who clamor to know forthwith how the molecules behave, * * * * *

* * * * * forgetful that all our

knowledge is and remains throughout provisional.' But inasmuch as Weismann has undertaken to teach us 'just how the molecules behave,' and since this is the *only* aim of his essay, it would seem that all such clamorings are entitled to some recognition. Unless the food of determinants is 'Ein ganz besonderes Saft,' one would think that the soma might be able to supply it in quantities large enough to cause the hungry determinants and biophores to stop their fighting. In all seriousness, it seems to me that to class such a purely figurative and imaginary 'struggle' along with Darwin's principle, as Weismann does, is to wholly disregard the importance of evidence.

3. The greatest objection to the all-sufficiency of natural selection, which Weismann, along with many others, recognizes, is 'the fact of a simultaneous, functionally concordant yet essentially diversified modification of numerous parts.' This objection Weismann thinks he has removed by assuming that the determinants may vary simultaneously and independently, and may increase or decrease in size through germinal selection. This does remove some of the difficulties; it furnishes, *ex hypotheso*, the individual variations for personal selection, but the one great difficulty remains untouched, viz., the *combination* of these individual variations into a functionally concordant system. This difficulty, which is really the only important one in this connection, remains just where it was before Weismann proposed his doctrine of germinal selection.

Weismann ably argues that there is in certain quarters an evident tendency to under-estimate the relative importance of theories as compared with facts, and he points out the great value of having symbols or mental images of natural processes, even though these symbols may not correspond to reality. Whether there are any such things as biophores, determinant,

germinal selection and the like, or not, it is at least evident that a mental symbol is better than mental vacuity, and that to have conceived a process by which the details of evolution and inheritance can be explained, even if it be a false conception, is better than no conception at all. Prof. Weismann is right when he says that there is no just cause for criticism of his system on the ground that it is purely imaginary, *provided it is always so treated and understood*. It is only when he says that certain imaginary processes *must be so*, as he does in this as well as in former essays, that it is pertinent to remind him that we are dealing, not with a system of necessities, but only with a series of mental images, each one of which may or may not correspond to reality.

I think it may well be doubted whether such speculations are at present the most profitable method of approaching the problems under discussion. Induction and the test of conceivability are distinctly inferior as scientific instruments to observation, experiment and deduction. Speculation is valuable only as it is verified by observation and experiment and while the solution of such recondite problems must be approached from all possible sides, yet it may be doubted whether it is more profitable for one to continue to start more speculations than a whole generation can run down rather than to take part in hunting down and verifying or rejecting his own speculations.

E. G. CONKLIN.

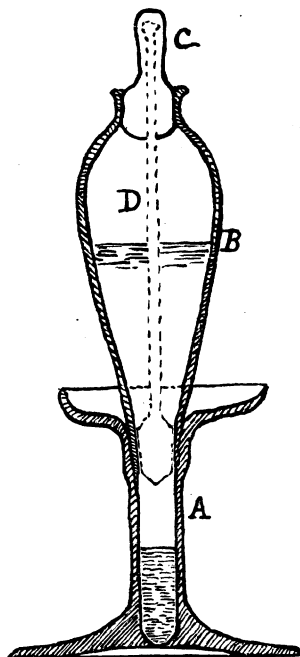
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THE SMEETH SEPARATING APPARATUS.

THE tube devised by Harada for using heavy liquids in separating the mineral constituents of rocks has been modified by Broegger, so as to obviate difficulties arising from the adherence of light and heavy particles desired to be separated. This ap-

paratus is more or less cumbersome and fragile on account of the stop-cocks it contains.

It appears to me that the separating tube proposed by Smeeth (Proceedings of the Royal Dublin Society, May, 1888, p. 58) has not been fully appreciated. The principle involved seems to be an excellent one, and by modifying the shape somewhat it can be much improved. With this end in view, several of the tubes were made by Eimer & Amend, of New York, after the design indicated in the accompanying figure. The apparatus consists of a cup-shaped base, A, with a hollow standard,



the tube B, to contain the heavy liquid in which the separation takes place, the stoppers C and D to close respectively the upper and lower ends of this tube. All of these separate parts have ground fittings, so as to be water-tight. The tube is so simple that no special explanation of the method of using it is needed. It will be seen that when the two stoppers, C and D, are out,

it affords an opportunity to stir both the material which has sunk to the bottom of the tube of the standard A, as well as that which floats upon the top of the heavy liquid in B, and by repeating the process several times it is possible to easily secure a complete separation.

It will be readily seen, also, that by inserting the stopper D, the tube B, with its contents of heavy liquid and light material floating on its top, can be removed. The heavy material can then be washed out of A, leaving this heavy material entirely separated in the standard A.

This apparatus, besides the advantage already enumerated, is especially stable and portable, and all the material during the separation is free from exposure to the air, features which give its great advantage in laboratory work.

J. S. DILLER.

U. S. GEOLOGICAL SURVEY.

CURRENT NOTES ON PHYSIOGRAPHY.

VALLEYS OF THE OZARK PLATEAU.

THE account of the Ozark mountains recently published by Keyes (see *SCIENCE*, Feb. 21, 1896) is followed by a valuable essay from O. F. Hershey on the valleys of the same region (*Amer. Geol.*, xvi, 1895, 338-357); the conclusions of the two observers agreeing in general as to processes of land sculpture, but differing somewhat as to geological dates at which various stages of the work of denudation were reached. A lowland peneplain has been uplifted to form the Ozark plateau; it is deeply dissected around the margin, so that the dis-severed hills are not inappropriately called 'mountains.' The ancient lowland is called a Tertiary peneplain by Keyes, and a Jura-Cretaceous peneplain by Hershey. The latter describes certain broad and shallow valley-troughs, slightly depressed beneath the general upland, as the work of Tertiary time in the gently uplifted Cretaceous peneplain. He concludes that the meandering

courses of the narrow young Pleistocene valleys are inherited from similarly curved courses on the flat floors of the old Tertiary valley-troughs in which the young valleys are incised; while the relative straightness of the Missouri is ingeniously explained as a consequence of its comparatively recent entrance into this region, after uplift in the region of the great plains.

COASTAL DESERT OF PERU.

MAJOR A. F. SEARS describes the coastal desert of Peru in a recent Bulletin of the American Geographical Society (xxvii., 1895, 256-271). The desert belt has its greatest width near latitude 5° S., where it measures about 120 miles to its inner margin, 1,000 feet high along the base of the western Cordillera; thence narrowing southward but extending about 2,000 miles along the oblique part of the South American coast. The surface is barren, except along the few river courses; crescentic dunes, or *médanos*, frequently occur; the drifting sand produces a sighing sound, like that from a forest under the wind. From December to March winds set on shore and give some rain to the Cordillera (apparently 'subequatorial rains'); then the rivers flow again, after having withered in the dry season. A graphic description is given of the 'coming of the river' in the case of the Piura. In February or March, when it is expected, travelers from up the valley are anxiously asked about its advance. When it is near the town of Piura, parties go out to welcome it with music and fireworks, returning with its trickling advance over the dry sandy bed. Thousands greet its arrival at the city. Excellent cotton is produced in the valley, and the crop might be much extended by systematic irrigation; but most of the water in the rising river is allowed to waste itself in the sea. Once in from five to seven years rain falls on the plain; then it is soon covered with grass and flowers, and

cattle wander out of the valleys for a time; but in a few weeks all is barren again.

LAKES IN THE SAHARA NEAR TIMBUKTU.

THE great northward curve of the Niger carries its fertile flood plain into the border of the Sahara, where Timbuktu stands near the margin of the upland in a region of sand dunes alternating with stunted forests. The wet season comes with the equatorial rains from June to August; but high water in the river is delayed until January, as if determined by rains about the more southern head branches. The river then overflows its broad flood plain, above which the villages stand on sand dunes. French occupation has brought to light several lakes that occupy depressions between spurs of the desert upland, which rises in abrupt rocky slopes a hundred meters above their waters. The largest, Faguibine, is about 60 kilometers north of the river and west of Timbuktu; it is 110 kilometers in length and over 30 meters deep; almost comparable, therefore, with Lake Chad. It is fed by a flooded tributary of the Niger during high water; in the dry season a current sets back again from the lake to the river. Debo is a somewhat smaller lake, apparently lying on the flat flood plain of the great river, 120 kilometers southwest of Timbuktu (Bluszet, *La région de Tombouctou*, Bull. Soc. géogr. Paris, xvi., 1895, 375-388).

Unless gratuitously explained by local subsidence, Faguibene may perhaps be regarded as one of those lakes that stand in a lateral valley near its junction with a main valley along which a great river has been actively building up a heavy flood plain.

PHYSIOGRAPHY OF MONTENEGRO.

A RECENT supplement to *Petermann's Mitteilungen* consists of 'Beiträge zur physischen Geographie von Montenegro,' by K. Hassert, *privatdocent* in Leipzig, giving a very serviceable account of this rugged and

out-of-the-way country. Successive chapters treat the previous studies, geological structure, surface form, landscape, springs and rivers, lakes, climate and plants. Special attention is given to the karst district of limestone understructure and subterranean drainage; the peculiar topography thus controlled being so fully developed that a considerable series of special terms is required to name its various features. Although having a plentiful rainfall, the karst surface suggests aridity by reason of the scantiness of soil and the frequent exposure of bare rock; and the loose-lying limestone blocks have not been without influence on the course of local history in furnishing ammunition for the 'stone batteries' with which Montenegrins on the valley sides have harassed the Turkish invaders in the defiles below. The uplands are frequently dissected by deep canyons, which greatly impede travel and trade; but the people have by long practice become expert in shouting across the chasms, thus sending both public and private messages.

Scutari lake, seldom over twenty feet deep, is explained as a limestone lowland, or *polje*, whose outward drainage is obstructed by the alluvial deposits of the river Drin.

As is often the case, the treatment of the different chapters is uneven. Careful discussion of origin is given to the forms of the limestone region; much less attention is given to such problems as the location of stream courses and the attitude of divides; an inward migration of the latter is strongly suggested by the short course of the Bojana system to the Adriatic and the long course of the Danube branches to the Black sea.

W. M. DAVIS.

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CURRENT NOTES ON METEOROLOGY.

INTERNATIONAL CLOUD STATIONS.

THE following is a complete list of the stations which are now taking cloud obser-

vations with photogrammeters, and theodolites, in connection with the scheme to be followed throughout the International Cloud Year, which has been extended until August 1, 1897. Paris; Upsala; Potsdam; Braunschweig; Danzig; St. Petersburg; Nijni-Novgorod (in summer); Batavia, Manila, and Sydney, N. S. W. The following stations are taking observations with theodolites: Washington, D. C.; Blue Hill Observatory, Readville, Mass.; Bossekop (in summer); Dorpat; Tiflis; Ekatherinenburg; Irkutsk. There will probably also be a second station in Australia, one in India and one at Lisbon.

ILLUSTRATIONS OF CLOUD TYPES.

IN connection with its work on clouds already referred to in SCIENCE, the Weather Bureau has issued a sheet giving illustrations of the typical cloud forms. The accompanying text contains descriptions of the clouds, and also data as to their mean heights and velocities. The sheet was prepared as an aid to observers in their cloud work. Most of the types selected are good, and the reproductions excellent as a whole. The alto-stratus and stratus are, however, unsatisfactory. The International Cloud Atlas, which has just been issued, gives us the cloud types selected by the International Cloud Committee, and these will, of course, now be the standard for the world.

THE ST. LOUIS, MO., TORNADO OF MAY 27.

WITH commendable promptness the Weather Bureau issued on May 29, a special *Storm Bulletin* (No. 4 of 1896), showing the weather conditions over the United States on May 26-28, in connection with which the severe tornado of May 27th occurred at St. Louis. The Chicago 8 A. M. forecast on May 27th predicted severe thunder storms for Illinois, Indiana and Missouri during the afternoon and night, and a special warning was sent out from Washington at 10:10 A. M.

CLIMATE OF THE FALKLAND ISLANDS.

IN a recent account of the Falkland Islands (Scot. Geogr. Mag., May, 1896, 241-252) mention is made of a striking effect of the high winds which are characteristic of the higher latitudes of the South Temperate Zone and are a marked feature of the climate of the Falklands. Owing to their being obliged constantly to beat against these violent winds, the inhabitants have acquired a peculiar gait that is so noticeable as to have gained for them the name of 'kelpers,' which is sometimes used as synonymous with 'natives.' R. DE C. WARD.
HARVARD UNIVERSITY.

CURRENT NOTES ON ANTHROPOLOGY.

RACIAL ELEMENTS IN ASSAM.

IN the *Times* of Assam, February 8, 1896, Mr. S. R. Peal gives the results of his extensive studies of the racial constitution of the Assamese people. The aboriginal inhabitants he believes to have been Dravidian, though at present he would not assign more than five per cent. to that element. They were overlaid by the intrusive Mon from the east, a monosyllabic stock, who in time were followed by a small invasion of Tibetans. All of these were weak and of low culture. The Hindu religions, the Aryan physique and the prevailing tongue were introduced by the immigration of Sanskrit-speaking conquerors at a remote epoch. They left such a profound impress on the earlier population and the existing Assamese language that Mr. Peal says of it: "With the exception of the Bengali, there is probably no derivative from the Sanskrit that bears a closer affinity to its parent." This was the extreme limit of the wave of Aryan migration which swept eastward across Bengal. The conquering Ahoms, from Siam, who in later centuries gained temporary control of Assam, exerted little permanent influence on its civilization or language.

THE TUPI LINGUISTIC STOCK.

THE eighteenth volume of the Bibliothèque Linguistique Américaine (Maison-neuve, Paris), which has just appeared, is a valuable member of the series. It presents the elements of a comparative grammar of the dialects of the Tupi linguistic stock of South America, prepared by the able pen of M. Lucien Adam, to whom we owe so many analyses of American tongues. The southern Tupi is known as the Guarani; and the 'Lingoa Geral,' spoken throughout Brazil, is a corrupt form of the same idiom. The stock is widely diffused, extending from Paraguay to Guiana, and for thousands of miles along the Amazon and its tributaries. Its literature is quite extended, the bibliography of it published in 1880 by Valle Cabral, numbering over three hundred titles.

M. Adam presents an analysis, carried through the principal dialects, of the phonetic laws of the stock, the expressions of the relations of possession and action (genitive and nominative), the pronouns, and an elaborate study of the conjugation. A comparative vocabulary with 358 titles is an extremely useful appendage.

The collation of the literature which he has utilized includes most of the best works, but I regret not to see included the excellent studies on the Neengatu of the late Mr. C. F. Hartt.

D. G. BRINTON.

SCIENTIFIC NOTES AND NEWS.

THE COLORS NAMED IN LITERATURE.

MR. HAVELOCK ELLIS has made (*Contemporary Review*, May) an interesting study of the color terms used by imaginative writers, which is a real contribution to scientific æsthetics. The fact that the Greeks did not name green and blue does not, of course, indicate (as Mr. Gladstone and others have alleged) that they could not see the more refrangible rays of the spectrum, but it does show a lack of interest in

	White.	Yellow.	Red.	Green.	Blue.	Black.	PREDOMINANT.
Mountain Chant.....	28	13	3	...	19	37	Black, white.
Wooring of Emer.....	34	3	48	14	Red, white.
Volsunga Saga.....	14	...	71	...	14	...	Red.
Isaiah, Job, Song of Songs..	18	4	29	33	...	15	Green, red.
Homer.....	21	21	7	2	...	49	Black, white-yellow.
Catullus.....	40	21	17	9	4	8	White, yellow.
Chaucer.....	34	10	28	14	1	13	White, red.
Marlowe.....	19	21	19	6	6	28	Black, yellow.
Shakespeare.....	22	17	30	7	4	20	Red, white.
Thomson.....	9	...	18	27	9	36	Black, green.
Blake.....	17	17	13	16	7	29	Black, white-yellow.
Coleridge.....	21	7	17	25	14	16	Green, white.
Shelley.....	17	19	11	21	21	11	Green-blue.
Keats.....	14	23	24	29	8	1	Green, red.
Wordsworth.....	14	18	10	35	11	12	Green, yellow.
Poe.....	8	32	20	12	4	24	Yellow, black.
Baudelaire.....	11	9	19	10	16	34	Black, red.
Tennyson.....	22	15	27	15	10	11	Red, white.
Rossetti.....	30	22	22	9	7	10	White, yellow.
Swinburne.....	28	18	28	16	6	4	Red, white.
Whitman.....	25	10	26	14	8	16	Red, white.
Pater.....	43	19	11	11	9	7	White, yellow.
Verlaine.....	20	15	24	9	14	18	Red, white.
Olive Schreiner.....	38	12	25	3	19	2	White, red.
D'Annunzio.....	15	11	46	7	14	6	Red, white.

these colors. Mr. Ellis's statistics are given in the above table, the number of times each of the colors is used by the author in selected passages being reduced to percentages.

Mr. Ellis makes a number of acute psychological and literary suggestions and concludes that a numerical study of color vision "possesses at least two uses in the precise study of literature. It is, first, an instrument for investigating a writer's personal psychology, by defining the nature of his æsthetic color vision. When we have ascertained a writer's color formula and his colors of prediction we can tell at a glance, simply and reliably, something about his view of the world which pages of description could only tell us with uncertainty. In the second place, it enables us to take a definite step in the attainment of a scientific æsthetic, by furnishing a means of comparative study. By its help we can trace the colors of the world as mirrored in literature from age to age, from country to country, and in finer shades among the writers of a single group. At least one broad and unexpected conclusion may be gathered from the tables here presented. Many foolish things have been written about the 'degeneration' of latter-day

art. It is easier to dogmatize when you think that you are safe from the evidence of precise tests. But here is a reasonably precise test. And the evidence of this test, at all events, by no means furnishes support for the theory of decadence. On the contrary, it shows that the decadence, if anywhere, was at the end of the last century, and that our own vision of the world is fairly one with that of classic times, with Chaucer's and with Shakespeare's. At the end of the nineteenth century we can say this for the first time since Shakespeare died."

GENERAL.

PROF. E. D. COPE has been elected an honorary member of the Academy of Sciences of Belgium.

Nature gives the following details regarding the approaching celebration of Lord Kelvin's jubilee as professor of natural philosophy in the University of Glasgow: On the evening of Monday, June 15th, at 8:30 p. m., the University will give a conversazione, when there will be an exhibit of Lord Kelvin's inventions. On Tuesday, June 16th, addresses will be presented to Lord Kelvin by delegates from home and foreign university

bodies, from several of the learned Societies of which he is a member, from student delegates from other universities, and from the students and graduates of the University of Glasgow. It is expected that the honorary degree of LL.D. will be conferred on the same day on several of the distinguished foreign visitors. On Tuesday evening, June 16th, the City will give a banquet to Lord Kelvin, to which the visitors who have come to do him honor have been invited. On Wednesday, June 27th, the Senate of the University will invite the visitors of the University staff to sail down the Clyde. The students of the University also invite the students' delegates from other universities to a similar trip. Representative scientific men—about fifty in number—from America and the British colonies, and from all the European countries, and about 150 from the United Kingdom, have signified their intention to be present.

In addition to the expeditions from Amherst College and from the Lick Observatory, University of California, parties are on their way from London and Paris to observe the eclipse of the sun from Japan. The English party includes the Astronomer Royal, Prof. Christie, Prof. Turner, of Oxford, and Captain Hills, of the Royal Engineers. M. Deslandres has charge of the French expedition.

THE Mayor of Bristol, at the instance of a deputation representing University College, Bristol, and other scientific institutions of the city, has invited the British Association to meet at Bristol in 1898. The Association met at Bristol in 1836 and in 1875.

THE Executive Committee of the New York Zoological Society has decided to send Mr. Hornaday to Europe to inspect the zoological gardens of Germany, Belgium, Holland, France and England. A Scientific Council has been appointed consisting of the following members: William T. Hornaday, Chairman, Director New York Zoological Park; Madison Grant, Secretary New York Zoological Society; Prof. J. A. Allen, curator of mammalogy and ornithology. American Museum of Natural History; Frank M. Chapman, assistant curator; Prof. Henry F. Osborn, Da Costa professor of zoology, Columbia University; Prof. Gilman Thompson,

University of New York; Dr. Tarleton H. Bean, Superintendent New York Aquarium; Dr. George Bird, Grinnell, editor *Forest and Stream*; and William A. Stiles, Park Commissioner and editor of *Garden and Forest*. The Sinking Fund Commission of New York, authorized by the Legislature to set aside land for the Gardens of the Society, has postponed action on the application of the Society for the use of 261 acres of land in Bronx Park. Mayor Strong, it appears, is opposed to granting the land.

PROF. R. S. WOODWARD, Prof. R. H. Thurston and Judge Arthur P. Greely have consented to act as judges in the competition for prize essays on 'The Progress of Invention during the past fifty years,' proposed by the *Scientific American*.

WE learn from *Natural Science* that the following changes have recently been made on the staff of the British Geological Survey: A. Strahan, to be geologist on the English branch, in place of J. R. Dakyns, who has retired after 34 years' service; C. T. Clough, to be geologist on the Scottish branch, in place of the late Hugh Miller. The gentlemen are succeeded as assistant geologists by Mr. T. Crosbee Cantrill, B. Sc., and Mr. E. H. Cunningham-Craig, in England and Scotland respectively. Dr. Molen-graaf, of Amsterdam, whose work in South African geology is well known, has been appointed State Geologist by the Transvaal Government.

THE *British Medical Journal* for May 23d is a special number commemorating the Jenner Centennial, being entirely filled with interesting accounts of Jenner and the subsequent progress of vaccination.

DR. BASHFORD DEAN, Messrs. Calkins, Harrington, Griffin and a number of students from Columbia University are about to start for Port Townsend, Washington, and will spend the summer in study and research on Puget Sound.

THE Brooklyn Institute has undertaken to collect \$3,000 for the purchase of the William Wallace Tooker collection of Indian relics.

THE New York University has conferred the degree of LL.D. on Prof. I. C. Russell, of the

class of 1872, professor of geology in the University of Michigan.

PROF. ALBERT S. BICKMORE, of the American Museum of Natural History, has gone to the West Indies to collect materials for a course of lectures for teachers, to be delivered in the Museum in the autumn. Mr. Dwight L. Elmdorf is already in the Windward Islands, taking photographs for the illustrations of the lectures. The expenses of the trip will be paid by the State, and copies of these lectures will be furnished to the public schools in the seventy principal cities and villages of the State.

PROF. MAX MÜLLER was made a Privy Councillor on the Queen's birthday. It is said that Huxley is the only man of science previously admitted to the Council in recognition of scientific work.

SENATOR MORRILL, from the Committee on Finance, made on June 4th a favorable report on the joint resolution authorizing the Secretary of the Treasury to have made a scientific investigation of the fur-seal fisheries.

GERHARD ROHLFS, traveller and explorer, died on June 3d, at Godesberg, Prussia, aged 62.

THE daughters of Carl Marx are collecting material for a biography of their father.

ON the evening of May 19th Prince Henry of Orleans delivered a lecture before the Royal Geographical Society, on his journey between Talifu (Yun-nan) and Sadiya (Assam). This is the shortest and most direct route from China to India. It was, however, traversed with great difficulty and is not practicable for trade.

PROF. L. L. DYCHE, of the University of Kansas, has gone to Alaska with a view to Arctic exploration.

AT a meeting of the Royal College of Surgeons, England, on May 14th the Walker prize was conferred on Mr. H. J. Stiles and the Jacksonian prize on Dr. A. A. Kanthack.

ON May 26th Prof. T. G. Bonney began a course of two lectures at the Royal Institution on 'The Building and Sculpture of Western Europe' (the Tyndall lectures). On 28th Mr. Robert Munro, Secretary of the Society of Antiquaries of Scotland, gave the first of two lec-

tures on 'Lake Dwellings,' and on Saturday, May 30th Dr. E. A. Wallis Budge, keeper of the Egyptian and Assyrian antiquities, British Museum, began a course of two lectures on 'The Moral and Religious Literature of Ancient Egypt.' Prof. J. A. Fleming lectured on 'Electric and Magnetic Research on Low Temperatures.'

WE are glad to learn that the editor of *Appleton's Popular Science Monthly* has invited President Mendenhall to reply to the article in the June number by Mr. Herbert Spencer criticising the metric system.

THE Washington *Star* states that Major Powell, Engineer Commissioner of the District of Columbia, has applied to the President, through Gen. Craighill, Chief of Engineers, for the detail of an officer of the engineer corps for duty with the District government as an assistant to the Engineer Commissioner, to fill the vacancy caused by the detachment of Captain Gustav J. Fiebeger, recently appointed professor of military and civil engineering at the Military Academy.

DR. WILLIAM COLLINGRIDGE, medical officer of the port of London, has been appointed as the Milroy lecturer for 1897, before the Royal College of Physicians, of London.

DR. A. GUNTHER has been elected President of the London Linnean Society. The gold medal of the Society has this year been awarded to Prof. George James Allman.

PROF. DARCY W. THOMPSON, of the University of Dundee, who has been sent by the British government to investigate the condition of the fur seals on the Prybilov Islands, left Washington for Alaska on the 3d of June. He will be accompanied by a Canadian naturalist, Dr. Macoun. They will go to the Islands on the 'Albatross,' which leaves San Francisco about the middle of the month.

MR. CLARENCE B. MOORE, who may be addressed at 1321 Locust street, Philadelphia, has kindly offered to present to any incorporated historical or archaeological society applying to him, his works on 'Certain Sand Mounds of Dual County, Florida;' 'Two Mounds on Murphy Island, Florida,' and 'Certain Sand Mounds of the Ocklawaha River, Florida.'

PROF. C. JORDAN, author of 'Traité des Substitutions,' 'Cours d'Analyse,' etc., expects to visit America the latter part of June. He intends to spend about three months in America, visiting mines and universities.

THE twenty-second annual meeting of the American Neurological Association was held at the College of Physicians, Philadelphia, on June 3d, 4th and 5th, under the Presidency of Dr. F. X. Dercum. The next meeting will be held at Washington, D. C.

THE party from Cornell University which will embark with Lieutenant Peary on the Kite is as follows: R. S. Tarr, professor of dynamic geology and physical geography; A. C. Gill, professor of mineralogy and petrography; J. A. Bonstell, assistant in geology; T. L. Watson, fellow in geology; E. M. Kindle, scholar in paleontology, and J. O. Martin, special student in entomology. It is the purpose of the party to make as thorough a geological study as is possible in five or six weeks, of the region near the Devil's Thumb, at the south end of Melville Bay and in addition to this to make collections of flora and fauna. Another party will also sail with Lieutenant Peary, under the leadership of A. E. Burton, professor of civil engineering, in the Massachusetts Institute of Technology. This party will land at the great Umanak Fiord. They will make pendulum observations, natural history collections and study the glacial phenomena. Lieutenant Peary himself will proceed north as far as Cape Sabine at the entrance of Smith Sound. He will also endeavor to explore Jones sound. He will be accompanied by Mr. Albert Operti, the artist, who will take casts of the Cape York natives for the purpose of making models for the American Museum of Natural History, New York.

IN connection with the the Millennial Celebration at Buda-Pesth the University conferred the following honorary degrees on May 13th: The degree of Doctor of Medicine on Prof. J. S. Billings, of New York; Sir. Joseph Lister, London; Prof. R. Virchow, Berlin; Prof. Than, Buda-Pesth; Prof. Anders-Retzuis, Stockholm; Prof. Guido Baccelli, Rome; Prof. Eduard Roux, Paris: The degree of Doctor of Philosophy, on

Prof. P. Berthelot, Paris; Mr. Herbert Spencer, London; Lord Kelvin, Glasgow; Prof. W. Wundt, Leipzig; Prof. Max Müller, Oxford; Prof. Grimm, Berlin; Prof. Lajos Lóczy, Buda-Pesth; Prof. R. W. Bunsen, Heidelberg; Prof. J. Bryce, Oxford; Prof. W. R. v. Hartel, Vienna; Prof. Hugo Schuchardt, Graz.

IN the last part issued of Engle und Prantl's *Natürliche Pflanzenfamilien*, Prof. Britton has been honored by the dedication to him of another genus, *Brittonastrum*, Briquet, in the Family Labiatae. There are six or seven species in the group, natives of the southwestern United States and Mexico.

PROF. J. J. THOMPSON was announced to give the Reade lecture at Cambridge University on June 10th, the subject being the Röntgen rays.

AT a meeting of the Paris Academy, on May 4th, M. Guinkoff stated that he had succeeded in photographing the retina. The experiments were made on himself, and he had obtained a photograph of the retina of his left eye with an exposure of two seconds. The process is not more trying to the patient than the ordinary examination with the ophthalmoscope and leaves a permanent record.

UNIVERSITY AND EDUCATIONAL NEWS.

THE University of Pennsylvania has received \$100,000 from Mr. Alfred C. Harrison, and \$10,000 each from Mr. John H. Converse, Mr. William P. Henszey and an anonymous donor.

AT a recent meeting of the Board of Regents of the University of Michigan reductions were made in some of the salaries, and several instructors were dismissed. A resolution was adopted that where any department has two or more full professors, only the senior by date of appointment shall at any time receive a salary of more than \$2,500. Law and medical professors, if they practice their respective professions, are to receive \$2,000, and if they do not, \$2,500. The psychological laboratory has been discontinued for one year.

IT is expected that Rev. George L. Perin will succeed Rev. Orello Cone as President of Buchtel College. Dr. John Clarence Lee has been

elected President of St. Lawrence University at Canton, N. Y.

FRANK L. McVEY, Ph. D., has been appointed instructor in economics at the University of Minnesota.

MR. F. P. SHELDON, for the past six years instructor in plant taxonomy at the University of Minnesota, has tendered his resignation in order to devote his energies to the management of his private business affairs and the profession of the law. Mr. A. A. Heller, late fellow of Columbia College and well known for his exploring trips in South Carolina, Texas, Idaho and the Sandwich Islands, will succeed Mr. Sheldon and will act as curator of the growing herbarium of the University.

THE following fellows in the sciences have been appointed at Cornell University: Entomology, James G. Needham, now instructor in Knox College, Illinois; mathematics (traveling fellowship), Prof. Paul Arnold, University of California; geology, Thomas L. Watson; agriculture, Leroy Anderson; mechanical engineering, W. O. Amsler; electrical engineering, L. A. Murray.

THE incomes of most of the colleges of Cambridge and Oxford have been greatly reduced by the agricultural depression. During the last university year the sum of only £72,943 was divided among the heads and fellows of the various colleges, as compared with £111,000 in 1882. The amounts contributed by the colleges for university purposes has been again decreased.

DR. DONALD MACALISTER has compiled, at the request of Syndics of the University Press, a guide entitled: *Advanced Study and Research in the University of Cambridge*, giving a clear account of the admirable opportunities offered for advanced study and research at Cambridge. As has already been stated in this JOURNAL, students holding degrees from other universities or having an equivalent training may pursue studies at the university and after two years of residence are admissible to the regular degrees. The facilities for study and research at Cambridge and Oxford are equal to those of German universities, and should attract an equal number of American students.

DISCUSSION AND CORRESPONDENCE.

PROF. BIGELOW'S SOLAR-MAGNETIC WORK.

TO THE EDITOR OF SCIENCE: Prof. W. S. Franklin, in his review of Prof. Bigelow's solar-magnetic work (this JOURNAL, Vol. III., No. 74), has performed a duty for which all meteorologists and physicists must thank him; but the question may fairly be raised as to whether the tone and temper of the performance were such as ought to characterize a report of an examination of even alleged scientific work. As one of many who have been more or less familiar with Prof. Bigelow's work during the past five or six years, I have all along been puzzled by the obscurity of his statements and the fact that I was unable to gain any intelligent idea of his methods. There was a certain satisfaction in finding that others met with no better success, although no one could deny the tremendous importance of the results which he thought he had reached. For most people life is too short for going over all the details of work which is being done by others, and usually a complicated scientific hypothesis receives its confirmation from verified prediction rather than from an analysis of methods and material. But while others have been waiting for Prof. Bigelow's work to prove itself by the practical application of which it was alleged to be capable, it is gratifying to know that some one was overhauling it and endeavoring to ascertain the foundation principles upon which it rests. It is quite proper that this should be done, and Prof. Bigelow or his friends can object only to the manner in which the reviewer has expressed himself. It will be admitted that there is a chance that Prof. Bigelow knows what he is doing, difficult as it seems to be for him to show other people, and it is to be hoped that he will not find in the unnecessarily harsh language of the review an excuse for ignoring it, but rather that he will not further delay an exposition, couched in simple and intelligible language, of the elementary and fundamental notions, definitions and principles on which his work rests. This might enable his friends to determine whether his theories 'are peculiarly wild and vagarious' or his results 'meaningless.' And he must not forget that their judgment has been in suspension for a long time. M.

VARIATIONS OF GLACIERS.

TO THE EDITOR OF SCIENCE: At the International Congress of Geologists at Zurich in 1894 a committee, with members representing various countries, was appointed to collect and make observations on the changes which are continually occurring in the length and thickness of glaciers. Much information bearing on the variations of the Alpine glaciers has already been collected, and it is now desirable to know something of the variations of glaciers in other parts of the world, to determine whether these variations are synchronous on different continents and on opposite sides of the equator. To what extent the variations of glaciers are dependent on meteorological changes, and to what extent on the size and shape of reservoirs, etc., is a problem whose solution is hoped for.

Many of your readers will doubtless visit American glaciers this summer, either on the Pacific Coast, in Canada or in Alaska; and I hope they will take sufficient interest in the subject to make observations which will be of value.

The information most desired regarding any glacier is whether it is advancing or retreating. In a memorandum issued by the Alpine Club the following criteria are given:

"When the ice is advancing the glaciers generally have a more convex outline, * * * and piles of fresh rubbish are found shot over the grass of the lower moraines. Moraines which have been comparatively recently deposited * * * are disturbed, show cracks, and are obviously being pushed forward or aside by the glacier.

"When the ice is in retreat the marks of its further recent extension are seen fringing the glacier both at the end and sides * * * ; the glacier fails to fill its former bed and bare stony tracts, often interspersed with pools or lakelets, lie between the end of the glacier and the mounds of recent terminal moraines."

For recording the extent of a glacier at the time of one's visit, many methods have been given. Among the simplest is to measure (or pace) the distance from the end of the glacier to some prominent rock, or to the line connecting two easily recognizable points on opposite sides of the valley. All photographs of the end of a glacier are useful, especially those taken from a station easily accessible and easily de-

scribed; photographs taken from the same station at a future date will show what changes have taken place in the interval.

Excellent results can be obtained from the following method: Select two stations on opposite sides of the valley a little below the glacier's end; mark and describe them; estimate their distance apart if no more accurate determination can be made; take a photograph of the glacier's end from each of these stations, and determine by compass the angle between the other station and two or three prominent peaks or other features that appear in each photograph. The photographs, the angles and the distance between the stations will be sufficient data to make a rough map of the glacier's end.* All photographs and observations sent to me will be carefully preserved as a part of a permanent record of American glaciers.

Muir glacier, Alaska, is so frequently visited that we should obtain a pretty complete history of its changes. A photograph of the north-western corner of the inlet, taken from the ship when at anchor, or, better still, from the projecting bluff on the eastern side of the inlet, will greatly help in making the record.

The few observations which have already reached me show that the glaciers about Glacier Bay, Alaska, the Illecillewaet, in the Selkirks, and those on Mt. Rainier, Washington, are retreating.

HARRY FIELDING REID.

JOHNS HOPKINS UNIVERSITY,

BALTIMORE, MD., May 23, 1896.

LIFE HABITS OF PHRYNOSOMA.

PROF. CHAS. L. EDWARDS's article on the reproduction of *Phrynosoma cornutum* (SCIENCE, May 22, 1896) interested me very much, indeed; but in some respects the article is misleading, as one might suppose from reading it, that Prof. Edwards believes that all the species of lizards of the genus *Phrynosoma* are *oviparous*, as he found *P. cornutum* to be. This is, however, by no means the case, for, as I have pointed out in SCIENCE over ten years ago (September 4, 1885, pp. 185-186), *Phrynosoma douglassii* is strictly *viviparous*, and its period of gestation

*A fuller account of the desired observations is given in the *Journal of Geology*, Chicago, Vol. III., 1895, pp. 284-288.

is probably about one hundred days. At the present writing I have alcoholic specimens of the young of this species that were given birth to in my presence by a specimen of *P. douglassii*, kept by me in captivity in New Mexico in 1885.

R. W. SHUFELDT.

MAY 27, 1896.

BOWS AND ARROWS OF CENTRAL BRAZIL.

EDITOR OF SCIENCE: I have just finished reading Dr. Hermann Meyer's 'Bogen und Pfeil in Central Brasilien' (Leipzig, 53 pp., 4 pl. of 67 figs., map), and find it good for sore eyes. His purpose to prepare a much larger work is declared at the outset, and his confession that the shortcomings and sins of collectors and labelers are at the bottom of the ethnographer's disappointments and errors will find an echo in many hearts. Indeed, Dr. Meyer has actually gone to the Mato Grosso to ascertain whether these things that were on his labels are really so.

All bows in South America are self bows. There is not now, and does not seem ever to have been, a made-up bow south of the Caribbean Sea. For the most part, these southern bows are very large, only in Guiana and the northwestern lands, as well as in the far south, in the Gran Chaco, on the Pampas and in Tierra del Fuego, are smaller forms in use. Quite contrary to Ratzel's observations on Africa, the powerful bows are to be found in forest regions, while the smaller ones are in the open.

In the central region studied by Meyer there are five types of bow, to wit:

1. The Peruvian, with rectangular long elliptical cross-section. The material is the heavy, black Chonta palm wood.

2. The North Brazilian, with semi-circular cross-section and made of a reddish brown leguminous wood.

3. The small Guiana bow, with parabolic cross-section, and often with a channel down the back. They are made of a dark brown wood. There are intermediate forms between 2 and 3.

4. The small Chaco bow, with circular cross-section and beautifully smoothed. Made from the red wood of the Curepay acacia.

5. East Brazilian bows of a variety of woods. There are two varieties, the eastern and the

western; the northern, or Shingu, and the southern, or Kameh, form connecting links between them. The western variety has circular cross-section, is made of strong wood and wrapped with 'Cipo' a Liana bast, used by the Bororo (Tupi). The eastern variety is of black Airi palm wood, in use among the Puri (Tapuya, or Gêz) and Botocudo (Tapuya, or Gêz).

Of arrows, Meyer characterizes six types, all having two feathers instead of three. In North America the Eskimo and several west coast tribes employed two feathers laid on flat, one above, one below. All the interior and eastern tribes seem to have had the rounded or cylindrical nock and three radiating arrows. The South American types are:

1. The East Brazilian or Gêz, Tupi feathering, occupying all east Brazil to the Paraguay and the Shingu. Two, whole, or seldom halved, feathers are laid on to the shaft flat, one above, one below, and seized with thread, filament or Cipo bast. These wrappings are frequently done in beautiful patterns and pretty tufts of feathers are inserted.

2. Guiana feathering, delicate and carefully laid on. Two short, half feathers are laid on and held fast by wrappings of threads here and there. Once in a while a North American arrow has the feathers thus made fast.

A bit of wood is inserted at the butt end for a nock piece.

3. The Shingu sewed feathering. Two half feathers are sewed on to the shaftment through little holes bored through on either side.

4. Arara feathering, two long half feathers held on by narrow bands of thread wrapping. At the butt end the wrapping is in beautiful patterns.

5. Mauhé feathering, like the East Brazilian, two whole feathers are bound on above and below. A neck piece is inserted at the butt end.

6. The Peruvian cemented feathering. The half feathers are first laid on and held in place by a coil of thread or bast from end to end and then covered with some sort of dark cement. This is subdivided into minor groups.

The shaft, the fore shaft, the barbs, the points of bamboo blades, of monkey bones or of wood, all receive minute attention. The most

of the treatise is devoted to the tracing of tribes (Stämme) by means of their bows and arrows.

Meyer's map will be a revelation to any student of South American ethnology. Brinton has traced the Arawak from the Paraguay river to the Bahama Islands. Long ago I was struck with South American characteristics upon wood carvings from Turk's Island and among tribes of the Southern States. Holmes draws attention to peculiar pottery marks from the South in the Gulf States, and Meyer shows that the region of the Matto Grosso northward was a *cloaca gentium*, especially the common sources of the Paraguay, the Shingu and the Tapajos and the lower courses of the Tapajos, the Madeira and the Negro. The Negro is joined to the Orinoco by the Cassiquiare, and from the mouth of the Orinoco to Florida is an unbroken chain of inviting islands. Dr. Brinton denies that the Carib stock passed far north into the Antilles, but there seems to have been an easy and much-frequented highway from the Paraguay as well as from Yucatan to Florida for peoples. In this connection von den Steinen, Ehrenreich and Im Thurn must not be neglected.

O. T. MASON.

SCIENTIFIC LITERATURE.

FOSSIL PLANTS OF THE WEALDEN.

The Wealden Flora. By A. C. SEWARD, M. A., F. G. S. Part I.—*Thallophyta-Pteridophyta*, London, 1894. Part II.—*Gymnospermæ*, London, 1895. Catalogue of the Mesozoic Plants in the Department of Geology, British Museum (Natural History). Parts I., II.

The second part of this important work has come to hand. The first part appeared in June, 1894, but as Part II. was expected even earlier than it arrived no review has appeared in America of Part I., and the whole work may now be treated together. An additional part is promised, which will embody certain critical discussions, but as no plants have been found in the English Wealden of higher rank than the Gymnosperms these two parts must contain an enumeration of the entire flora so far as known.

At the time of receiving the first part I was about starting for Europe, and while there I made some investigations in the Wealden with

a view to comparing that formation with the Potomac of the United States. I was therefore able to make excellent use of the information it contained when preparing a paper on 'Some Analogies in the Lower Cretaceous of Europe and America' for the Sixteenth Annual Report of the U. S. Geological Survey (pp. 463-542), chiefly growing out of the observations I had made. That paper is now in press, but it might have been made much more complete if I had received Part II. of this work in time to make use of it. As I have expressed in that paper my appreciation of the important information contained in Part I., and have embodied a considerable part of it in the comparisons there instituted between the Wealden flora and that of the Potomac formation, it is not necessary to go into detail relative to this portion of Mr. Seward's work. Its title sufficiently indicates its scope; thirty distinct forms are treated, the greater number of which are ferns. There are two algæ, one Chara, one hepatic and three species referred to Equisetites. Nine of the forms have more or less geographical distribution outside of England, and a table is given showing this.

It may be said of the whole work that, although constituting, as the title page indicates, the beginning of a catalogue of the Mesozoic plants in the British Museum, it is much more than a catalogue. All the material in the Museum has been carefully revised, and though treated somewhat by number it is dealt with in a systematic way, and there are many references to similar material in other museums. The literature of the subject is also fully given, and all new material is described and named. There is a large amount of this latter, the greater part of which has been collected by Mr. P. Rufford, of Hastings, for whom many species and one genus have been named. Many of the old specimens collected by Mantell and the early geologists have been thoroughly worked over and referred to modern genera, so that we now have some idea of the real nature of such objects as *Endogenites erosa*, which is shown to be a fern (*Tempskya Schimperii* Corda), while the old genera Pecopteris, Alethopteris, Lonchopteris, and most of Sphenopteris have been brought within the Mesozoic genera, Matonid-

ium, *Cladophlebis*, *Weichselia* and *Ruffordia*. Anyone who has had to deal with these old names can realize the importance of Mr. Seward's work.

In Part II., so recently published and to which it is proposed chiefly to draw attention, Mr. Seward has taken up the Gymnosperms, which, as already remarked, are the only Spermatophytic or Phanerogamic plants which have, as yet, been found in the Wealden. These all belong to the two orders Cycadaceæ and Coniferæ, unless we suppose, as Mr. Seward seems to do, in common with most other authors who have studied that group, that the Bennettitæ constitute an order distinct from and intermediate between the Cycadaceæ and the Coniferæ.

Mr. Seward has devoted considerably more than half his space to the Cycadaceæ in the wider sense, and, although the number of forms is not large, still the great difficulty that attends the study of this class of material, as well as the importance that such a study has, both for biology and geology, fully justifies the thoroughness of his treatment. In view of the recent importance which the subject of cycadean vegetation has assumed in America, this able and excellent review of it by so competent an authority as Mr. Seward is in a high degree timely and valuable.

Although he gives the opinion of the leading investigators, Carruthers, Solms-Laubach, etc., to the effect that the Bennettitæ cannot be placed in the Cycadaceæ, still he does not himself make this distinction in the work before us, and treats all the forms that have been commonly referred to the Cycadaceæ under that ordinal name. His subdivision is mainly into *Frondes*, *Trunci* and *Flores*, and in addition to these he deals with several doubtful organs and with numerous seeds (Carpolithes).

One of the most valuable parts of the work is an extended discussion of the fossil Cycadaceæ, occupying twenty pages. He first goes over the evidence for the existence of this family in Paleozoic beds, and the conclusion is decidedly in favor of such a view, with, however, the qualification that the Paleozoic Cycadaceæ are more or less synthetic in their nature and possess marked relationships with less highly developed groups and especially with ferns. I know of no other

place in which the proof of the Pteridophytic ancestry of the Cycadaceæ in particular and of the Gymnosperms in general has been so ably marshaled. It constitutes another step in the general march of botanical science towards the breaking down of the barriers which formerly so completely separated the Cryptogams from the Phanerogams. Only those narrow systematists who are chiefly in search of differences, and who so dread to encounter resemblances, can regard this in any other light than that of true scientific progress.

Of the forms which are known only by their fronds Mr. Seward recognizes six genera and fourteen species in the English Wealden. The genera are: *Cycadites*, *Dioonites*, *Nilssonia*, *Otozamites*, *Zamites* and *Anomozamites*. Of these *Otozamites* is represented by six species and varieties, *Cycadites*, *Dioonites* and *Zamites* by two each, while of *Nilssonia* and *Anomozamites* only one species of each has been found thus far. Four of these forms are described as new, two of which, *Cycadites Saportæ* and *Zamites Carruthersi*, have the rank of species, the other two new forms being varieties of the old species *Otozamites Klipsteinii* Dunk., of the German Wealden. The remainder of the fronds are identified with species long since recognized either by the earlier English or by Continental authorities.

Each of these genera and many of the species are carefully discussed and a somewhat extended synonymy is appended. Numerous changes are also made, of which only one need be mentioned, viz., the adoption of Schenk's view of the form which has so long gone by the name of *Dioonites Buchianus* (Ett.) Born., and its reference to the genus *Zamites*. This has special interest for the American paleobotanist, because it is one of the most abundant forms in the oldest beds of the Potomac formation. This form was first supposed (Göppert, 1847) to belong to *Pterophyllum*, and its provisional reference to *Dioonites* by Bornemann in 1856 would have received little attention had it not been adopted by Schimper in his *Traité de Paléontologie Végétale*, and its reference to Miquel's genus *Dioonites* has always been doubted by some authors. The last change was that of Nathorst, who, recognizing its affinities with

Zamia rather than with *Dioon*, proposed in 1890 to call it *Zamiophyllum*. This is in harmony with Nathorst's fundamental principle of nomenclature to make all doubtful genera founded on leaves terminate in *-phyllum*. Objectionable as this rule is in the case of dicotyledonous leaves (see Amer. Journ. Sci., 3d Ser., Vol. XXXI., May, 1886, pp. 370-375), it is still more so for plants of lower rank, as monocotyledons, while in families in which the appendicular organs are not true leaves, but fronds, as in the case of cycads and ferns, this practice is highly objectionable, and it is matter for congratulation that Mr. Seward, in recognizing the same truth perceived by Nathorst, has restored Schenk's name. Apropos of this form it is to be noted that Mr. Seward declines to recognize Prof. Fontaine's two varieties from the Potomac formation and Nathorst's variety from Japan, and that he also includes in this species the other Japanese form to which Nathorst gave the name *Zamiophyllum Naumanni*.

Passing over many other interesting features of this portion of the work and also his treatment of flowers and fruits, we come to the section which, just at present, has the greatest interest for the student of American paleobotany, viz., that which treats of the cycadean trunks. It is no secret that a monograph on the Cycadean Trunks of North America is in preparation at the U. S. National Museum, and that a large amount of material, especially from the Potomac of Maryland and the Lower Cretaceous of the Black Hills, has been brought together as a basis for this study. Several preliminary notes and papers have already appeared,* bearing on this subject, but unavoidable delays have prevented the progress of the work, and it will be some time before its completion. This much is said because Mr. Seward has several times referred to the probable early appearance of this monograph (see Pt. II., pp. 120-121 of the work under review). One of the causes of delay was the necessity which was felt of visit-

ing the European museums and examining the great collections of cycadean trunks in England, France and Italy. The paper above referred to* gives a somewhat full account of the investigation of this nature which was made in 1894.

In restricting the Wealden to the beds that lie between the Purbeck and the Atherfield beds (he seems to include the Lower Greensand) Mr. Seward has excluded from the consideration of cycadean trunks the oldest and best known forms, viz., those from the 'dirt beds' (Purbeck) of the Portland quarries, first described by Buckland in 1828 under the name of *Cycadeoidea*. The number of distinct forms confined to the true Wealden is not large and Mr. Seward has treated them under the generic names *Bucklandia*, *Fittonia*, *Bennettites* and *Yatesia*. *Bucklandia* includes certain cylindrical trunks of considerable height in proportion to the diameter, the most important being *B. anomala* (Stokes & Webb) Carr., first described in 1824 as *Clathraria anomala* Stokes & Webb, though previously collected and subsequently treated by Mantell under the name *Clathraria Lyellii*. A large number of specimens of this are in the British Museum, all of which have been examined by Mr. Seward and separately described. There are also some forms exhibiting only the medulla or pith, which Mr. Seward thinks may belong to *Bucklandia*, but which come under Saporta's designation *Cycadeomyelon*. Two species of *Yatesia*, one of which is the *Y. Morrisii* of Carruthers, are also enumerated, but Mr. Seward seems to have grave doubts as to whether this genus can properly be separated from *Bucklandia*. A new species of *Fittonia* from Mr. Rufford's collection is described, but scarcely any mention is made of the original species *F. squamata* Carr., because it is in the Geological Museum on Jermyn street. It is a pity that this work should not have sufficiently expanded to include all the material from the Wealden, seeing that so nearly all is actually in the British Museum.

We come now to that form which is certainly of the greatest interest from whatever point of view, viz., the genus *Bennettites* of Carruthers,

*See SCIENCE, Vol. XXI., June 30, 1893, p. 355; Proc. Biol. Soc. Washington, Vol. IX., April 9, 1894, pp. 75-88; Journ. Geol., Vol. II., April-May, 1894, pp. 250-266; Bull. Torr. Bot. Club, Vol. XXI., July 20, 1894, pp. 291-299.

*Sixteenth Annual Report U. S. Geol. Surv., 1894-'95, pp. 463-542, pl. xevii-cvii.

upon which has been founded a distinct order Bennettiteæ. This is not the place to go into a full discussion of the important characters which distinguish this form. They have been fully considered by Carruthers, Solms-Laubach, Saporta and Lignier. Mr. Seward sums them up with characteristic conciseness and refers to this genus six or seven distinct forms including the *B. Saxbyanus* and *B. Gibsonianus* of Carruthers. Solms-Laubach, it will be remembered, confined the genus to the latter of these species solely on the ground that the remarkable trunk found on the Isle of Wight and so fully illustrated by Carruthers is the only one in which the included seeds are clearly shown. The remaining species he preferred to place in Buckland's old genus *Cycadeoidea*. Since the publication of Lignier's interesting researches upon the structure of *B. Morierei*, the opinion has gained recognition that there is a close relationship between the genus *Williamsonia* and *Bennettites*. Mr. Seward fully discusses this in an extended introduction to a new species collected by Mr. Rufford in the Fairlight clays near Hastings, which he names *Bennettites (Williamsonia) Carruthersi*. This species is represented by no less than seventeen specimens, and in addition to this there is a variety (*latifolius*) of which some dozen specimens occur. These all come under the head of *Flores* or floral organs, which are carefully illustrated in two plates and one text figure. Some of these forms certainly resemble those referred to *Williamsonia* from the Potomac formation; others, it must be admitted, can scarcely be separated from the specimens so fully illustrated by Lignier, while still others seem to be substantially identical with those figured so long ago by Young and Bird from the Yorkshire Oölite and subsequently treated by Williamson under the name of *Zamia gigas*. Carruthers recognized the undesirability of referring such forms to the genus *Zamia*, and therefore founded the genus *Williamsonia*.*

So far as known at the present writing, none of the cycadean trunks of America reveal the presence of the included fruits characteristic of *Bennettites Gibsonianus*, but in all other impor-

tant respects these trunks resemble those which Mr. Seward refers to this genus, and also all those which Count Solms-Laubach would include under the name *Cycadeoidea*. So far as their general appearance is concerned, both the American and the Italian forms depart from the original type of Buckland more widely than from the *Bennettitean* trunks of the Wealden. The fact that Count Solms appears to have found included anthers in the great Italian trunk *Cycadeoidea etrusca* seems to indicate that throughout this great group of closely similar forms the reproductive organs were the same, and that the failure to find fully developed seeds in the interior of most of these trunks is due to defective preservation. It is not probable that these seeds could long remain thus imbedded in the cortex; they must have possessed some mode of extrusion, and it must have been a rare accident that a trunk should be entombed at the precise time when its mature seeds were still included. This seems to have been the case with *B. Gibsonianus*—a most happy accident for science. But in most other specimens, and especially in many of the American, there are indications within the floral axis of the remains of former organs that have disappeared. In some specimens these flowers closely resemble the one studied by Lignier, and the enveloping bracts are either still preserved or else are indicated by definite cavities having the same form. It therefore seems at least a reasonable conclusion that most or all of the trunks referred to *Cycadeoidea* by Solms-Laubach are of practically the same nature as *Bennettites Gibsonianus*. Further investigations now in progress are likely to throw additional light upon this subject.

One other supposed cycadean trunk described by Mr. Seward is of special interest because it is that upon which was formally founded the *Dracæna Benstedii* Koenig, which occurs so often in the books. We have here at last the history of this problematical form, first mentioned by Mantell as having been discovered by Bensted at Maidstone and supposed by him to be related to *Yucca* or *Dracæna*. Koenig, who was keeper of the Mineralogical Department of the British Museum where the specimens were, seems to have labelled them by this name, and

*See SCIENCE, N. S., Vol. II, No. 32, August 9, 1895, p. 147.

Morris in his Catalogue of British Fossils, perpetuated it. Mr. Seward has examined the specimens and finds them to be in all probability cycadaceous, but he unfortunately declines to apply to them either a generic or specific name. This disposes of the last claim of the British Wealden to any monocotyledonous vegetation, the old *Endogenites erosa* having been long since referred to the ferns.

The coniferous vegetation of the Wealden is only second in importance to its cycadean vegetation. It is not as well preserved and there is no doubt much truth in Mr. Seward's remark that "as a general rule, fossil conifers are perhaps the most unsatisfactory plants with which the palæobotanist has to deal; structureless and imperfectly preserved fragments of broken twigs, isolated cones, leaves or seeds, have usually to be determined separately, and it is only in comparatively rare instances that we are in a position to connect cones and vegetative branches."

Sixteen distinct forms are enumerated in this catalogue. They are all referred to the genera *Araucarites*, *Pinites*, *Sphenolepidium*, *Thuites*, *Nageiopsis*, *Pagiophyllum* and *Brachyphyllum*. The largest number of species belongs to *Pinites*, viz., five, while of *Sphenolepidium* there are three, and of *Araucarites*, *Pagiophyllum* and *Brachyphyllum*, two each. It is interesting to note that three of the specimens in the Rufford collection are referred to Prof. Fontaine's Potomac genus, *Nageiopsis*, and Mr. Seward regards them as probably the same as *N. heterophylla* Font. *Pinites* is represented chiefly by cones, which somewhat resemble those of *Abies*, and this is perhaps the most unsatisfactory group of the conifers. The two widely distributed species of *Sphenolepidium*, *S. Kurrianum* and *S. Sternbergianum*, both originally from the Wealden of Germany, and both of which occur in the Potomac formation, are also found in the Wealden of England. Mr. Seward is disposed to include Prof. Fontaine's *S. virginicum* and also his *Athrotaxis expansa* under *Sphenolepidium Kurrianum*. Another species is either the same as or closely related to the *Sequoia subulata* of Heer, also found in the Potomac formation. It would perhaps not be wholly untrue to regard the genus *Sphenolepidium* as a

sort of connecting link between the Araucarian and the Sequoian types of coniferous vegetation.

A very brief space is devoted to the coniferous wood of the Wealden, and it would seem from the specimens enumerated that there is in the British Museum no material whatever from the celebrated 'pine raft' of Brook Point, on the Isle of Wight. This seems surprising, in view of the great prominence and wide fame of these petrified remains. Only a macroscopic examination seems to have been made of the few specimens from Hastings and Ecclesbourne. This is very disappointing to those who would be glad to avail themselves of the knowledge that could be so easily acquired from this important class of material. If we knew the structure of all the fossil wood of the Wealden of England we should doubtless have a good basis upon which to judge of much of the other material that is so largely in doubt.

The great botanist, Robert Brown, in the early years of the century, examined the internal structure of this fossil wood of the Isle of Wight and reported that it agreed with that of the Norfolk Island pine (*Araucaria excelsa*). No figures were ever published that I can learn. On my brief visit to the island I collected a few specimens, and these have been prepared and slides mounted by Dr. Knowlton. His report upon them is contained in the paper above referred to.*

The Araucarian type of structure is not found in any of the fossil wood of the Potomac formation, but has been found in that of the Lower Cretaceous of the Black Hills. It is the common type of the Older Mesozoic (Upper Triassic) deposits of the Eastern United States. The Potomac wood is all of the Sequoian type, although it has been called *Curpressinoxylon*. Hitherto no plants of that class have been found in the Wealden, but the occurrence of *Sequoia subulata*, or a species closely allied to it, together with the forms of *Sphenolepidium*, seem to mark a transition from the Araucarian to the Sequoian conifers. It may be that the numerous imperfectly preserved cones that have been referred to *Pinites* belong to the same plants whose wood is preserved in the

*Sixteenth Ann. Rept. U. S. Geol. Surv., p. 496, pl. cii., figs. 5, 6 (in press).

Wealden, and this is almost certainly the case with the specimen referred to *Araucarites* (*Conites elegans* Carr. and *Kaidacarpum minus* Carr.). The difference, therefore, in this respect between the Potomac formation and the Wealden may not be as great as was supposed.

My principal object in visiting the Wealden was to see what could be learned of its relationship with the Lower Cretaceous of the United States, and in the paper already twice referred to I have pointed out all such relationships, both stratigraphical and paleontological, that I was able to detect on that brief visit. The general result seems to be that there are marked similarities in both these respects, and that the Wealden formation is like the Potomac, not only in its flora, but also in the manner in which it was laid down. The two seem to form a special epoch in the history of geology, and it may well be that the events which their strata record were in large part taking place at the same time on both sides of the Atlantic.

In reviewing such an important and able work as the one before us, it is greatly to be regretted that there should be anything in it to which a hearty assent can not be given, and it is fortunate that the only part of the book from which anyone could dissent is that which relates to so unimportant a matter as nomenclature, which is regarded by many as of no consequence at all in comparison with the scientific problems that are demanding solution. And yet we can no more dispense with a nomenclature than we can dispense with language. It is in a certain sense the language of science, and as such it should possess all the precision that science requires in all departments. Those who regard it as of no value should not forget that the great Darwin, whom no one can accuse of being a systematist in any sense of the word, considered the subject of nomenclature of such paramount importance that he actually bequeathed a sum of money to be devoted thereto; and all scientific workers, I think, no matter what branch of science they pursue, feel the same need that the language of science and the nomenclature of its innumerable facts, especially in the organic world, be reduced to the most perfect form for their use.

In what I shall say relative to the nomencla-

ture employed in this book, I do not wish to be understood as specially criticising its author, but rather as characterizing, in the most general way, what I regard as a defective system. This peculiar nomenclature is, so far as I am aware, confined to the botanists and paleobotanists of Great Britain and of one or two botanical centers in the United States. In all other branches of science and among botanists of all other parts of the world, no such system is employed, and it is not tolerated except by this restricted class. It is based on the assumption that the author of a name has no more title to that name than anyone else, and that any subsequent author is at liberty to change any name that he regards as 'objectionable.' Of course there is no agreement whatever as to what makes a name objectionable, and therefore in practise it amounts to the right of any author to change any name at will. It is this principle, or, rather want of principle, that has thrown the nomenclature of botany into such inextricable confusion and renders it next to impossible for any writer who has not all the botanical literature of the world before him to decide what is the true name of any genus or species. I will cite only three cases in the present work as fairly illustrative of this point.

On page 173, Mr. Seward creates a new genus *Withamia*, as a 'substitute' for Saporta's genus *Cycadorachis*, given by the latter to forms found in the lower Kimmeridgian, which he believed to represent the rachis of a cycad frond. In making this change Mr. Seward remarks: "Although it is held by some a wrong course to adopt, I propose to substitute, in the case of *Cycadorachis armata* Sap., and the almost identical fossils from the English Wealden, a new generic name in place of that instituted by Saporta. To retain Saporta's genus, with the recently discovered specimens before us, would be practically equivalent to assigning the plant to a position which appears to be entirely at variance with the facts. I propose, therefore, to institute the new genus *Withamia* for these spiny axes with leaf-like appendages, and in doing so to place on record some slight recognition of the immensely important service which Witham of Lartington rendered to paleobotanical science."

I cite this case as an exceedingly moderate one. Probably no better reason could be assigned for changing a name. But what will be the result? Some later author, with better specimens at hand, will think he discovers the relation of these forms with some genus or family, and will therefore again change the name so as to indicate this determination; or he may have no better reason than the laudable wish to do honor to some other eminent predecessor whom he regards as having been neglected, and then we shall have three names for the same thing, and so on indefinitely.

I will cite in the next place, the case of *Yatesia Morrisii* Carr., described on page 166. Here a short synonymy is given with the date of each change placed conspicuously at the left, and the first entry in this synonymy is:

1867. *Cycadeoidea Morrisii*, Carruthers, Geol. Mag., Vol. IV., p. 199.

If the reader turns to the reference given in the *Geological Magazine* he will find a paper by Mr. Carruthers entitled 'On *cycadeoidea Yatesii*, a fossil cycadean stem from the Potton Sands, Bedfordshire.' If I had not happened to have worked up this synonymy I should of course have accepted Mr. Seward's statement, but having done so and arrived at the conclusion that the true name must now be *Yatesia Yatesii* Carr., I was, of course, struck by the discrepancy. It is true that Mr. Carruthers in his subsequent larger paper in the Linnæan Transactions, three years later, at the time that he founded the genus *Yatesia*, had called this from *Yatesia Morrisii*, evidently because he considered that to give Yates's name to both genus and species was 'objectionable.' But why, in giving the synonymy, should not the actual facts be stated, so that the responsibility should rest where it belongs? The entry *Cycadeoidea Morrisii*, Geol. Mag., 1867, is simply a falsification of the record. Although Mr. Seward's synonymy appears upon the face to be carefully prepared, yet such facts as these show that it is not to be trusted, and the reader is compelled in every case to go back to the original and find out whether the entry is correct or not. Clearly such synonymy is far worse than none.

The third and only other case that I shall

cite is that of *Bennettites Gibsonianus* Carr., on page 142. Here ten references are given in the synonymy under the name, representing three changes. Mantell's *Clatharia Lyellii* has, of course, been set aside for proper reasons, and the earliest entry by Carruthers is that of *Bennettites Gibsonianus* in Trans. Linn. Soc., Vol. XXVI., p. 700, 1870. The last entry in Mr. Seward's synonymy is as follows:

1894. *Cycadeoidea Gibsoni*, Ward, Biol. Soc. Washington, Vol. IX., p. 80.

From this the reader will, of course, suppose that the last named author deliberately changed the specific name from *Gibsonianus* to *Gibsoni*, and will hold him responsible therefor. Very few will have before them the little paper quoted, but those who chance to have it will find on the page cited that the first entry under the synonymy is as follows:

1867. *Bennettites Gibsoni* Carr., Brit. Assoc. Rep., 37th meeting, Pt. II., p. 80.

This entry is correct, but is conveniently omitted in Mr. Seward's synonymy. This spelling of the specific name, therefore, has three years priority over the other, and if there were any other test of the propriety of a name than that it is the first one given, the earlier one in this case is the better, because the specimen was collected by Gibson, and the general practice is to employ the genitive form for names of persons who have some immediate connection with the specimen, usually as collector, and the adjective form for those whose connection is remote, and especially where the purpose is merely to honor one who may not be related to the existing case at all. But two reasons are no better than one. The reference to Mr. Carruther's earliest name should, of course, have been given under its proper date, and the last entry should have been:

1894. *Cycadeoidea Gibsoni* (Carr.) Ward. This would have completed the record and satisfied the ethics of the case.

Of course, it may be objected that the name *Bennettites Gibsoni* Carr. was a *nomen nudum*, as no description or figure accompanied it in the note referred to, but the school of botanists to which reference has been made have never troubled themselves with any such refinements in nomenclature as this. Mr. Carruthers pre-

ferred Brongniart's *nomen nudum* *Mantellia nidi-formis* to Buckland's *Cycadeoidea megalophylla*, although the latter was thoroughly described and illustrated and also had priority, as he, himself, admits. In the example before us the last author named is, of course, responsible for referring Bennettites to Cycadeoidea, which, whether correct or not, was a legitimate change and the reasons were given in the paper referred to.

These three cases will suffice to furnish the standard by which the whole is to be judged, and it is obvious that the system of citation adopted in this work, which is simply representative of the whole class of writers referred to, and for which its author should not be held personally responsible, involves both the *suppressio veri* and the *suggestio falsi*. That this should be tolerated in any department of science, the essence of which is truth, is surely beyond the ordinary comprehension.

LESTER F. WARD.

WASHINGTON, D. C.

A Summary Description of the Geology of Pennsylvania. J. P. LESLEY, Harrisburg. Vols. I. and II., 1892; Vol. III. in 2 parts, 1895. pp. 2638 and 611 pl., with an index volume of pp. 98 and xxx.

These volumes, completing the series of Pennsylvania reports, are offered as a digest of about one hundred volumes, averaging not far from two hundred pages each. A review, even a synopsis, is impossible; space admits merely of a notice.

Prof. Lesley's contribution covers the column from the base to the Mauch Chunk of the Lower Carboniferous; failing health compelled cessation of work at that point, and the compilation had to be completed by others. The portion described by Prof. Lesley is found in the most complicated part of the State, and the problems with which he had to deal were numerous and perplexing. The conclusions offered by geologists in adjoining districts were often discordant, and the termination of the survey came too soon to admit of careful re-study of doubtful areas. As a result, the first two volumes of this report contain many defective spots, which the author does not at-

tempt to conceal. The Cambrian and Ordovician, studied chiefly during the early years of the survey, need thorough revision, and the relations of the Pennsylvania Silurian to that of other States are still somewhat obscure. The discussion of the Devonian is careful and as acceptable as any discussion of the Pennsylvania Devonian can be at this time. The numerous deep oil borings in southwest Pennsylvania and West Virginia will afford new material for study of the problems involved. Prof. Lesley's industry is simply appalling; he has mastered the details of the reports in such way as to make them his own, and his portion of these volumes bears his own stamp on every page, so that we have not a mere compilation but a real presentation of the geology as far as the condition of our knowledge warrants. His anxiety to escape the 'error' of the director of the First Geological Survey of the State is shown in the effort to fasten every geologist's name to his work, even, at times, to the extent of crediting to the geologist in charge of a district observations which were only confirmatory of his own made many years before. His readiness to give a hearing to both sides is evidenced not merely by the insertion of an argument, by another, of thirty pages controverting a position strenuously defended by him for more than twelve years, but also by his relegation to the doubtful column of opinions long regarded by him as proved.

The Mauch Chunk west from the Anthracite fields and the Pottsville conglomerate throughout the State are described by Mr. d'Invilliers in Vol. 3, pp. 1833-1915. The synopsis of the labors of Prof. White and others is given clearly and compactly and with a reasonable effort to assign to each author proper credit for his work.

The Anthracite fields are described by Mr. A. D. W. Smith on pp. 1916-2152; this summary appears to be in large part supplementary to the reports and work of Messrs. Ashburner and Hill.

The Bituminous coal fields are described by Mr. E. V. d'Invilliers, on pp. 2153-2588, this description forming the greater part of Vol. III., Pt. I. Mr. d'Invillier's work has been conscientious and successful, so that his

synopsis cannot fail to be useful to geologists as well as satisfactory to the citizens of Pennsylvania, the features of the beds being given in great detail. This synopsis cannot fail to be gratifying, in one sense, to Mr. d'In villier's predecessors in the bituminous fields, for he has made excellent use of their work. But an oversight, doubtless unintentional on Mr. d'In villier's part, cannot fail to detract from the pleasure with which his predecessors should read his synopsis; he has failed to give credit to them in the proper places to such an extent that those who use his work hereafter will be apt to regard him as author rather than as compiler.

The report closes with a review of the New Red, by Mr. Benjamin Smith Lyman, which is a synopsis of his own work and a valuable contribution to the literature of the subject.

The index is quite a marvel in its way. If the purpose of its maker had been to conceal the names of the geologists on whose observations the report is based it could hardly have been more successful along that line. Of the geologists in charge of districts, Dewees, W. G. Platt, Carl and Prime are not mentioned; McCreath, whose chemical work made the survey celebrated, is ignored in the same way. No notice is taken of the work of F. and W. G. Platt, Stevenson and White in the bituminous fields; even Lesley himself is alluded to but once, while the work of one of the compilers requires twenty-six references, that of another five, and that of a third none. The list of publications following the index is even more successful than the index itself, for all of the volumes appear to be anonymous except the two publications by Dr. Genth.

JOHN J. STEVENSON.

Neudrucke von Schriften und Karten über Meteorologie und Erdmagnetismus, herausgegeben von
PROF. DR. G. HELLMANN.

No. 5. *Die Bauern-Praktik*. 1508. 4°. Pp. 83.

No. 6. *Concerning the Cause of the General Trade Winds*. By GEORGE HADLEY. London, 1735. 4°. Pp. 21.

Facsimiledrucke, mit Einleitungen. Berlin, A. Asher & Co. 1896.

One of the signs that meteorology is now rapidly advancing as a science is the fact that more and more attention is being directed to the ancient writings which marked the first steps in its development. As new discoveries are being made, and as the modern literature of the subject is increasing, we appreciate more fully what the early students and writers did for us, and we are glad to become familiar with their work. The return to the older authors has brought out, during the past two or three years, some interesting translations and reprints of ancient writings on meteorology. The most notable set of such publications is the series of *Neudrucke von Schriften und Karten über Meteorologie und Erdmagnetismus*, edited by Dr. Hellmann, of Berlin, a very devoted student of meteorology. These reprints are attractively gotten up in rough, white paper covers, and are facsimile reproductions of the originals. Each number contains bibliographical and historical notes prepared by Dr. Hellmann, which is equivalent to saying that they are full, accurate and interesting.

The series of *Neudrucke*, which already included four reprints of old and rare publications, has lately been enlarged by the addition of two more volumes, Nos. 5 and 6. The first, No. 5, is a reprint of *Die Bauern-Praktik*, originally published in 1508 and undoubtedly the most widely known of all meteorological books. The original went through sixty editions in Germany, and was translated into French, English, Danish, Norwegian, Swedish, etc. The weather prognostics and rules of *Die Bauern-Praktik* may be found in the manuscripts of the 10th to 15th centuries, and, in their beginnings, may be traced back much further, even to the days of the Indo-Germanic tribes and to the ancient Chinese. The principal part of the original publication deals with the forecasting of the weather for the whole year on the basis of the weather observed on Christmas and on the twelve days following it. Although, of course, of no practical use to us at the present day, this reprint is of much interest historically to antiquarians and those interested in folk-lore, as well as to meteorologists.

No. 6, of the series, is a facsimile reprint of

Hadley's *Concerning the Cause of the General Trade Winds*, originally published in the *Philosophical Transactions* in 1735. This paper, although very short, was one of very great importance in relation to the theory of the trade winds. Hadley's explanation of the direction of these winds, which he rightly ascribed to the deflective effect of the earth's rotation, was not complete or accurate, yet his theory is commonly found given in many books of the present day. The paper was distinctly epoch-making, and, as such, is well deserving of a place in Dr. Hellmann's admirable series. The notes in the Hadley reprint are as full and as suggestive as in the other numbers.

The publishers of the *Neudrucke* are Asher & Co., of Berlin, but we are informed that Dr. Hellmann has sent over several copies of each of the last two volumes to Mr. A. Lawrence Rotch, Readville, Mass., in order that Americans may be saved the trouble of writing to Europe for them. The reprints may be obtained at cost price on application to Mr. Rotch, the price of *Die Bauern-Praktik* being \$1.75, and that of the Hadley reprint 50 cents.

R. DE C. WARD.

SCIENTIFIC JOURNALS.

PSYCHE, JUNE.

THE body of the number contains but a single short article, in which J. W. Folsom describes and figures a new Thysanuran which he regards as representing a new genus and family, Neelidæ. Two supplements are added, in one of which T. D. A. Cockerell continues his descriptions of new species of bees of the genus *Prosapis*, mostly from Colorado and Nevada; in the other F. C. Bowditch gives a list of 674 Coleoptera found on Mt. Washington, N. H., both above and below the timber line, with brief notes.

SOCIETIES AND ACADEMIES.

BIOLOGICAL SOCIETY OF WASHINGTON, 262D
MEETING, SATURDAY, MAY 16.

THE evening was devoted to the discussion of *The Fauna and Flora of the Islands off the Coast of Southern and Lower California, Including the Gulf of California*.

Dr. E. L. Greene discussed in brief the flora of the islands. The entire group, from Guadalupe, off the coast of Mexico, lying a hundred miles or more distant from the mainland, to those forming the channel of Santa Barbara and holding distances of only thirty and forty miles from the Californian shore, is a remarkable group among continental islands, as presenting in its flora so many points of divergence from that of the adjacent mainland. The islands of the Atlantic seaboard, even those lying farther out at sea than do any of those of the Californian coast, yield only such genera and species as are common on the continent. But in the case of the Mexico-Californian group there are not less than fifty good species already known which are absolutely peculiar to the islands; some of them representing even generic types, like *Lyonothamnus*, consisting of two very distinct species—one a large shrub, the other a small tree—with no very near relatives in any other part of the world. *Crossosoma*, another genus of shrubs, has one fine species indigenous to several islands, with none on the immediately neighboring mainland, though a second small and insignificant member of the genus occurs away beyond the continental mountain ranges, on the verge of the deserts of the distant interior. And this insular genus *Crossosoma* is almost more than a genus. It probably represents a natural order, some authors referring it to the Dilleniaceæ, the genera of which are all Australian and South American, others placing it provisionally in the Papaveraceæ, while in character it is different from either family. The most surprising case of entire divergence from continental flora is that of four very strongly marked species of *Lavatera*, which are scattered up and down the archipelago, while not a single species is indigenous to the American continent, either North or South, all the generic allies of these fine shrubs being of the flora of the Mediterranean region, with the exception of three or four, which are confined to remote and truly oceanic islands.

Another and negative point of divergence between the insular and mainland floras is the almost or quite total absence from the island of representatives of certain of the most prevalent mainland genera, such as *Ribes* *Lu-*

pinus Astragalus Potentilla Horkelia and many more. Equally remarkable and interestingly suggestive is the fact that certain trees, shrubs and herbaceous plants, long known as extremely rare, or quite local, on the mainland shores—such as *Pinus Torreyana*, *Malacothrix incana* and *Leptosyne gigantea*—have more recently been found to occur in the most luxuriant abundance on these outlying islands. Their rare occurrence on the continental shore is at just those points where their seeds would naturally land if drifted across from the islands. The conclusion is unavoidable that, in so far as these belong to the continental flora, they have been given to it from the islands, these latter being their original habitat. In a word, the character of this insular flora departs from almost all known rules, and in so far that, viewed as to their flora, the whole group seem like oceanic islands crowded over against the border of a continent.

The land mammals of the islands were discussed by Dr. Edgar A. Mearns, who enumerated, in addition to the genus *Homo*, twelve genera and upwards of twenty species of native terrestrial mammals which are at present known to inhabit the islands off the coasts of southern and Lower California, and alluded to others remaining to be described by the energetic and adventurous naturalist, Mr. Walter Bryant, whose explorations of Guadalupe, Cedros, Esperito-Santo and the other islands off the Pacific and Gulf coasts of Lower California are so well known to naturalists.

Dr. Mearns described and exhibited specimens of a new mouse (*Peromyscus*) and a new kangaroo rat (*Dipodomys*) recently collected on Tiburon Island, in the Gulf of California, by Mr. J. W. Mitchell, who accompanied Prof. McGee on his latest expedition. He also remarked upon the close relationship existing between the island mammals as a whole and those of the neighboring mainland, insomuch that their origin from the latter could be readily traced in each instance, though none are actually identical, thus furnishing a plain and striking illustration of the evolution of species.

Of domestic animals, the goat, sheep, cow, donkey, dog, cat and house rat have been introduced on one or more of the islands; and, in

several instances, some of them bid fair to destroy the native fauna or flora of certain islands.

In the discussion which followed this paper, Dr. C. Hart Merriam added a genus to the known mammal fauna of these islands, a species of the little spotted skunk (*Spilogale*) having been taken on Santa Catalina Island, one of the Santa Barbara group.

A skin of the Western Desert mule deer, (called '*Burro*'), was sent to the Society for examination by Prof. W J McGee, who obtained the specimen in the Sierra Seri Sonora. Dr. Mearns had also found this deer on the Western desert tract, both east and west of the Colorado river.

Mr. Harry C. Oberholser spoke briefly of the birds of the island, calling attention to the number of subspecies which were evidently descended from continental forms.

F. A. LUCAS,
Secretary.

GEOLOGICAL SOCIETY OF WASHINGTON.

At the 50th meeting of this Society held May 27th, the last meeting until next fall, the following papers were read and discussed:

Texture and Structure of Soils: By PROF. MILTON WHITNEY, of U. S. Department of Agriculture. The following forces are usually spoken of as the principal ones in the disintegration of rocks and the formation of soils. 1. Changes of temperature. 2. Moving water or ice. 3. Influence of vegetable or animal life (shades the land; admits air; solvent action of the roots; chemical action of decaying organic matter, earthworms and bacteria). 4. Chemical action of air and water. 5. Oxidation and hydration. Attention was called to the fact that all of these forces, except the solvent action of water and hydration, are largely superficial and would not act at any considerable depth. They certainly can not explain the disintegration of rocks to a depth of 50 or 75 feet as is seen in the crystalline areas at the south. If the solvent action of water has been the main cause of the disintegration of rocks, then 50 per cent. of the rock must have been dissolved and carried away. If the

rock has been split up by mechanical means into the minute grains of sand and clay then the resulting material must have swelled to twice its original volume. Lantern slides were exhibited showing the shape of soil grains and the relative size and surface area, and to illustrate some of the physical properties of sand and clay. Slides were also shown illustrating the texture of soils, and the economical importance of this subject in the distribution of crops was pointed out, the texture of soils adapted to many of the principal crops being shown.

By the structure of soils is meant the arrangement of the soil grains. This has an important geological bearing and a very important economic side. Slides were used to show grains of soil unflocculated as they exist in a puddled clay and flocculated as they exist in a loam soil. The effect of this on the relation of soils to rainfall was explained and the economic importance of the difference in the conditions maintained by the soils owing to the difference in the structure was pointed out.

Topographic Nomenclature of Spanish America. Mr. Rob't T. Hill, of the U. S. Geological Survey, read a paper upon the names given by the Spanish people to the topographic features of the United States, illustrating by appropriate lantern slides. It was held that with one or two exceptions, Spanish words could be found upon the published maps for nearly all topographic forms. Over fifty of these terms were defined and illustrated, and Mr. Hill proposed that many of them be adopted into the English language and used for forms for which the latter possess no appropriate terms. The paper will be published in full. W. F. MORSELL.

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, MAY 26, 1896.

A PAPER entitled 'Catalogue of the Species of Cerion, with Descriptions of New Forms,' by Henry A. Pilsbry and E. G. Vanatta, was presented for publication.

Mr. Edw. Goldsmith reported that a specimen of supposed Geyserite from Hawaii had been found by him to be an amorphous, soluble sulphate of lime. The substance was found on the edge of the crater of Kilauea, associated with sulphur deposits.

Prof. Edw. D. Cope exhibited the skull of a whale from the Miocene of the Yorktown epoch. It adds another species to the whalebone whales, and establishes their direct relations to the Zeuglodonts. The elongation of the parietal and frontal bones is characteristic. The form is allied to the genus *Cetotherium*, and is described under the name *Cephalotropis coronatus*.

Dr. M. V. Ball described a human exencephalic monster born in about the seventh month. The brain, although extruded, is well developed. There are six digits on one hand. No reason could be suggested for the occurrence, the parents, grandparents and a number of brothers and sisters being normal.

Botanical Section, May 11, 1896, Dr. Chas. Schaeffer, Recorder.—Mr. Thomas Meehan stated that he had observed that the flowers of *Draba verna* are often self-fertilized by the two long arcuate stamens, while in *Capsella*, of the same order, this is not the case. He believes *Draba* to be both protandrous and proterogynous.

Mr. Beringer exhibited a very tomentose specimen of *Quercus alba*, and gave new localities for *Carex baratii*.

A committee, consisting of Edw. D. Cope, Benjamin Sharp and H. Frank Moore, was appointed to draft resolutions for presentation to the next meeting expressive of the Academy's opinion on the subject of the anti-vivisection bill now before Congress.

EDW. J. NOLAN,
Recording Secretary.

NEW BOOKS.

Miscellaneous Papers by Heinrich Hertz, with an introduction by PROF. PHILIP LENARD, translated by D. E. JONES and G. A. SCHOTT. London and New York, Macmillan & Co., Ltd. 1896. Pp. xxvi+340. \$3.25.

The Gypsy Moth. EDWARD M. FORBUSH and CHARLES M. FERNALD. Boston, Wright & Potter Printing Co. 1896. Pp. xii+495+C=100.

Biological Experimentation, its Functions and Limits. SIR BENJAMIN WARD RICHARDSON. London, George Bell & Sons; New York, The Macmillan Co. 1896. \$1.00.